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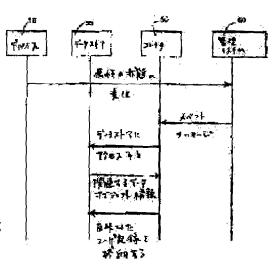
(54) STORAGE RESOURCE MEASURING SYSTEM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a storage resource measuring system that identifies the usage status and measures a change in the attribute required for account billing.

SOLUTION: This invention provides a management system that monitors a change in the attribute and, based on the result, generates an event message. A storage collector communicating with the management system filters information related to the account function. The storage collector generates a usage event record, accesses the management system, and checks if there is a data object that generates a change in the attribute. Such additional information is related with the usage event record and is stored for later use in starting an account application.

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CLAIMS

[Claim(s)]

[Claim 1]An event-driven resource measurement system used with a
storage system, comprising:

A managerial system which communicates with a storage system.

Said managerial system constituted so that at least one use attribute
relevant to said storage system might be defined and an event message
corresponding to change of a use-before account attribute might be
published.

At least by one side of communicating with said managerial system,
accessing creating record about said event message, and said managerial
system, and acquiring additional information relevant to said change of
said use attribute. A storage collector constituted so that a selected event
message might be answered.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]Especially this invention relates to resource measurement of an information storage system in relation to the surveillance of an information resource generally.

[0002]

[Description of the Prior Art]Like a Storage Area Network (SAN:Storage Area Network) system, in a complicated storage system. In many cases, data is intelligently distributed to various storages, and while improving access performance, it is thought desirable to reduce storage cost. A storage management software system is frequently used because [this]. Such a storage management system performs various data administration facilities and storage area controlling functions, such as application controlling, resource availability management, network management, a performance management, service management, a system management, and other similar managements.

[0003]In addition to an above-mentioned data administration facility and storage area controlling function, a storage AKAUNTANTO (accountant) function is also needed for some system users. In a large-scale enterprise system and service provider, the storage assigned to an end user is evaluated or measured, and it is often required that a financial analysis, budgeting, and the charge back (application for payment) should be performed. Goods were classified into various service levels according to some storage providers, and the information relevant to such a service level is managed by them. If storage fee collection application or such a function is used, the storage provider can analyze and collect the costs

about providing a storage service.

[0004]The problem in the case of providing such a storage accounting function is in the diversity of the storage system composition which may exist, and the diversity of the element which a specific system administrator is going to supervise. For example, a certain system administrator is going to calculate a utilization charge based on the using state of input and output and a file system. The administrator can also calculate cost from a network domain, a host, storage, and other physical or logical sides. Or a price setting rule for exclusive use may be provided, and fee collection adjustment may be required in real time.

[0005]Some storage systems are designed in addition to this provide various service levels at various prices. the service level of an "economy" -- Japanese -- the memory and search of information accompanied by the help desk support in the next tape backup and the usual business hours are provided. In the service level of a "standard", an economy level is improved and the RAID0 redundant disc system accompanied by the help desk support on the 365th is mounted for 24 hours. The standard level was improved further, mirroring was added to all the disk drive systems, and redundancy is strengthened with the "premium" service level to RAID5. Thus, various fees are set up to various service levels, and, generally it is related with various storage resources, such as Logical unit (LUN) in a storage device.

[0006]

[Problem(s) to be Solved by the Invention]The storage fee collection application needs to recognize the using state of such Logical unit, and needs to extract the suitable attribute which a claim may generate. There are system operating status of the ownership of storage, a storage capacity, a storage service level (cost), and storage, etc. in the general attribute of a storage resource. Generally the cost of a storage resource is

determined in a storage capacity and the combination (based on cost /
capacity / time) of service level cost.

[0007]

[Means for Solving the Problem]This invention provides a storage
accounting system and a method, is supervising, evaluating and
processing a suitable attribute about a storage resource in a storage
device, and provides measurement information which brings about fee
collection and other control report functions. A system of this invention
is event-driven. This system supervises a datastore related with a storage
resource, and an event message which shows that other attributes of a
database object or a storage system were changed is answered. This
system answers such an event message and can perform two tasks. First,
excessive information which applies a filter to an event message and is
unrelated to an accounting function to perform is excepted, and it is
checked whether other objects related with an object which investigated
the contents of the datastore and was changed are. If such a related object
is specified, since this system collects suitable information about a
related object collectively, it can generate perfect fee collection record
and can store it in a moment of change of a resource shown by an event
message. A function in which the 2nd was enumerated is investigating a
datastore and specifying a related object, and shortly after a change
object of this ** is specified, it is performed. In this way, in this system,
before a value of a related object is changed by other users' operation or
the operation which is unrelated to an event under surveillance,
information about a related object is collectable. A resource measurement
system and a method by this invention can be mounted without changing
the conventional system substantially. In this invention, neither an
addition nor change also of an addition of hardware also needs software
to a storage device. Since this invention functions appropriately equally

by storage storage of various vendors and can divide a storage resource into various service levels easily, the fee collection claim of various costs of relation can be carried out, and it can assign them.

[0008]In a desirable embodiment of this invention, this system pursues a storage resource attribute including storage ownership (ID of the party concerned to whom storage is assigned), a storage capacity, a storage service level (cost), and an operation situation of storage. These attributes are only the examples typical attribute type usually used with storage fee collection application. This invention is not limited to these attributes. In this invention, any attributes of a storage resource and a storage device (either or both) can be supervised.

[0009]

[Embodiment of the Invention]In order to understand the purpose and advantage of this invention and this invention in detail, the drawing of explanation following the next of this application specification and attachment is referred to.

[0010]This invention is understood more by details with the drawing of an embodiment of the invention and attachment.

[0011]The suitable embodiment (one or more) of this invention explained from this is for only showing an example, and does not limit this invention and its application, and any directions.

[0012]Reference of <u>drawing 1</u> shows the typical network to 15. Two or more storage devices, such as the device 10, are contained in the network. A Storage Area Network (SAN) system may be sufficient as these devices, and the storage device by which direct continuation was carried out may be sufficient as them. Users, such as the customers 20 and 22, or a customer accesses these devices via the network 15. This system is provided with the managerial system 60 which maintains the datastore 40 related with each device 10. The information about various attributes

relevant to the storage resource defined by the storage device and the storage device is stored in the datastore so that it may explain in full detail enough below.

[0013]The storage collector 50 communicates with the managerial system 60 via the network 15. A storage collector creates the information about a using state, and it stores this until it is required from the fee collection application 80. The storage collector 50 functions as a primary interface of the fee collection application 80 and the managerial system 60.

[0014]The customers 20 and 22 show drawing 2 the typical fee collection application which accesses different Logical unit in the storage device 10a and 10b. A different service level (cost) is related with the Logical unit generally expressed with the reference number 20. Each customer is charged based on calculation in consideration of a service level and the capacity of Logical unit. Although what kind of composition it may be sufficient as the storage devices 10a and 10b, it is shown by here as a storage area network system provided with two or more control modules 16 and 18, respectively.

[0015]If the attribute of a certain storage resource changes, the datastore 40 (drawing 1) will publish an event message via the managerial system 60. Thus, a managerial system supervises the using state of all the devices, and carries out the role of the medium engine which outputs the information which shows such use in a common format. Generally, the managerial system can provide data to various applications apart from the fee collection application explained here.

[0016]The storage collector 50 is reserved to a specific use event, when this kind of event occurs, it processes it, and it generates required accounting information in real time.

[0017]Since an event can be published at any time, the storage collector 50 is designed answer asynchronously. An event functions as a trigger,

and a storage collector processes this and collects information required for a claim function.

[0018]Operation of the desirable system of this invention is shown in drawing 3. If a user accesses the Logical unit on a storage device, the state of one or more attributes of this device will change, the managerial system 60 will detect this, and a change event message will be published. Since the storage collector 50 acquires these event messages and applies a filter, only the thing related to an accounting function acts.

[0019]Reception of the message of relation will check whether a storage collector has a related data object which accesses the datastore 40 and influences an accounting function. A storage collector collects such additional information, also when it does not relate to a change event directly. This is for guaranteeing that the snapshot about the state of the storage system by a storage collector is provided with all the pertinent information required for execution of a claim function. It is important that a storage collector accesses a database promptly after receiving the first change event message, and grasps the state of a related object. Since this system is designed supposing a multiple user's access, this work is required. Other users may access a related object and may change this without a notice. For this reason, this system cannot be found also while giving a third party an opportunity to change a related object, and it is designed acquire the state of a related object promptly and efficiently.

[0020]The desirable storage collector of this invention is outputted to the datastore or file system which collects use events and fee collection application can access.

[0021]As for a storage collector, it is preferred to be designed suit specific sauce and comprise information on the attribute set relevant to this sauce. It is necessary to determine and describe the attribute used as a standard for fee collection application to charge a customer via an

external configuration file. By this method, the storage collector 50 can specify the event which influences these attributes as a thing relevant to a claim or a measurement system. The time stamp in which it is shown when the related event occurred must be contained in a use event.

[0022]The storage collector 50 operates by an infinite loop, and generates use record new whenever a related event is detected. Next, each use event is stored in external data storage or an output file, and is used with an accounting system.

[0023]Generally in fee collection application, fee collection is specified are based on the ownership of a storage resource.

[0024]To be shown in drawing 1, the storage collector 50 provides the interface to the managerial system 60, and controls generation of use record of a storage related event. In the architecture of this invention, a managerial system can supervise the using state of the network of all scales. For example, a storage collector is **(ed) and fee collection application 80 which pursues the attribute of the Logical unit on a storage device like Logical unit 20 of the storage device 10 can be mounted. The event which shows that it is necessary to start adjustment of a claim simultaneously [whenever a certain attribute of Logical unit is changed] with this change is generated. The attribute changed ranges from a change peculiar to a device to quota change, such as a new owner, a fee, etc., like capacity change.

[0025]In fee collection application, discontinuation of service is also an important problem. When a storage resource becomes access impossible, the user of the resource must not be charged to discontinuation. However, since a managerial system is only a server on a network, the managerial system cannot access the resource, but the owner of a resource may be able to access. The accounting system needs to provide reliability as much as possible also to the time when the down was recorded, and, in

such a case, copes with it.

[0026]The information collected by this module is periodically written in a nonvolatile field. Even if the extensive obstacle of a system occurs and the information on the newest cycle is generally lost, in order to guarantee that data is not lost, this cycle is much shorter than a actual fee collection cycle. Since each group of output record can be deleted without influencing other records after using information with fee collection application by this, a cleanup becomes easy.

[0027]At the time of initial starting of the storage collector 50, the information relevant to each storage resource which exists in a database is promptly stored in a nonvolatile power range (a file or a database) now. Therefore, the starting point when change to each storage resource is recorded is provided. when a storage collector carries out multiple-times starting between 1 fee-collection requisition cycles, the duplicate excessive information is saved, but it may be old, without providing old information and the overlapping information -- it is necessary to carry out a data synchronization

[0028]In desirable operation, the storage collector 50 operates continuously. The writing of recovery information and the mechanism of search are provided. This mechanism is used in order to check that it is in a suitable state for the information on a storage collector to continue collection of an event after the newest shutdown. The flashing mechanism which finally carries out the flash plate of the contents of the event information collected by the storage collector 50 now to a nonvolatile power range is provided. This mechanism is used periodically and stored in the form which the event information of this time can search with an accounting system. A flashing mechanism is a mechanism which assigns the use record accumulated till the present to permanent (permanent) storage from a temporary output.

[0029]In the desirable embodiment of this invention, the storage collector 50 shown in drawing 1 is a claim or a primary interface of measurement application and the managerial system 60. A storage collector receives the event generated by change of the demanded object which accesses the datastore 20 that it solves and is alike, and is managed via a datastore.

[0030]Drawing 4 is a data flow chart showing the data flow which passes the storage collector 50. In the process of composition, the storage collector 50 reads information required for initialization of itself, and initial setting is carried out. The attribute which serves as a standard for an accounting system to determine which event is suitable is also contained in this setting out. A storage collector sets up an event listener of a certain kind, and starts the receipt of a change event. A listener object makes a change event find out about it and intercept, and returns these to a search mechanism.

[0031]Detection of an event will investigate whether it relates to a billing system. Establishment of relation will extract suitable information required for a billing system by an extract function.

[0032]At the time of return, the detailed and suitable information on the event written in a temporary power range (either a file or temporary data storage) by points in time, such as a flashing mechanism of a storage collector, is called. Before storing event information, other processings may be performed about an event, but it is not a range made into the object of this invention.

[0033]Special starting mode is recommended. If the storage collector 50 is performed first, the state of each storage resource known within the database now is read first, and the event showing each state is stored. The first state that can record change of an event drive now is provided.

[0034]The recovery mechanism which the storage collector 50 performs

is called only at the time of starting, and if there is temporary information from a front [shutdown] by starting a flashing mechanism, it will carry out the cleanup of this. The result guarantees that the start state for adding event information is effective. Other only error recovery which can be processed here is disappearance of an event. However, this invention has set up some conditions which avoid loss of an event to a system. Any mounting guarantees deleting a disappearance event, after certainly taking out warning. This is the most important, when the composition of a storage resource is changed while the managerial system was down. When a managerial system starts backup again, these change is detected and the changed information is recognized as an event. Once this system starts, generating of an event can be trusted, and although the database object was added, changed and deleted, the listener detects.

[0035]As mentioned above, although the example of this invention was explained in full detail, the example of each embodiment of this invention is shown hereafter.

(Embodiment 1) At least one use attribute relevant to the managerial system which communicates with a storage system, and said storage system is defined, Said managerial system constituted so that the event message corresponding to change of a use-before account attribute might be published, At least by one side of communicating with said managerial system, accessing creating the record about said event message, and said managerial system, and acquiring the additional information relevant to said change of said use attribute. The event-driven resource measurement system used with a storage system provided with the storage collector constituted so that the selected event message might be answered.

(Embodiment 2) The system of the preceding clause 1 statement is further provided with the storage network, The system of the preceding

clause 1 statement performing at least one side of said managerial system's communicating via said storage system and said network and said storage collector communicating via said managerial system and said network.

(Embodiment 3) Said storage collector observes an event message continuously, It is characterized by performing at least one side, although two or more records related with providing asynchronous communication with said managerial system and an event message were generated, and it comprised answering an event message and generating use recorded information as it stored, A system given in the preceding clause 1 further provided with the fee collection application constituted so that it might communicate with said storage collector and use report information might be generated based on said two or more records.

(Embodiment 4) Said storage system is composed by the storage resource group related with various use costs, A system given in the preceding clause 1 further provided with the fee collection application which communicates with said storage collector which relates said use cost with record of said event message.

(Embodiment 5) The step which creates use record paying attention to said event message at the time of reception, How to measure the storage system resource using state containing the step which processes said use record by accessing said managerial system and acquiring the additional information relevant to change of said attribute.

(Embodiment 6) A method given in the preceding clause 5 which contains further the step which applies a filter to said event message based on a series of rules defined a priori.

(Embodiment 7) A method given in the preceding clause 5 which contains further the step which collects and stores two or more use records, and accesses said stored use record.

(Embodiment 8) A method given in the preceding clause 5 which contains further the step which said storage system is composed by the storage resource group related with use cost, and relates use cost with said use record.

(Embodiment 9) A method given in the preceding clause 5 performed because the step of said attention works the storage collector which generates use record at the time of reception of a change event message.

(Embodiment 10) The step of said processing specifies at least one database object related with said changed attribute, A method given in the preceding clause 5 performed by acquiring the information about other database object groups which accessed said managerial system and were related with said one database object within the database.

[0036]Since the explanation about the above this invention is only a thing aiming at illustration intrinsically, there is change which does not deviate from the gist of this invention within limits made into the object of this invention. That in which such modification deviates from the pneuma and the range of this invention is not regarded.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1]The block diagram of the storage network system used for one suitable example of this invention.

[Drawing 2]The block diagram showing one suitable example of this invention.

[Drawing 3]The figure showing the sequence line for explaining the message processing process by this invention.

[Drawing 4]The data flow chart for explaining operation of the storage collector of one suitable example of this invention.

[Description of Notations]

10: Device

20 or 221. customer

40: Datastore

50: Storage collector

60: Managerial system

80: Fee collection application

16, 18: Control module

56: Datastore

50: Collector